

## Breeding *Bos javanicus* d'Alton cattle in Eastern Indonesia: Cattle reproduction<sup>1</sup>

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**ABSTRACT:** Reproduction of *Bos javanicus* d'Alton (Bali) cattle was monitored on Lombok. Traditional management at Tandek included continuous mating and late weaning. Key elements of new management at Kelebu included 6-month natural mating using a selected bull and weaning at 5-6 months of age. The Kelebu bull mated with up to 5 females daily, achieving 52-69 pregnancies each year. Kelebu weaning rates increased from ~65% to >90% with few calf losses. Kelebu villagers found weaning easy and effective. At Tandek, weaning rate averaged 76% and calf mortality 13%. This study demonstrated that well-managed Bali cattle have high reproductive capacity.

**Key words:** Bali cattle, reproduction, seasonal mating, weaning

### INTRODUCTION

Holmes (1987) (quoted by McCool 1992) identified the major constraint to development of a productive and efficient beef sector in eastern Indonesia as poor nutrition. Native *Bos javanicus* d'Alton (Bali) and crosses with *Bos taurus* cattle predominate in the region. Bali cattle have a small mature size and appear tolerant of diseases, parasites, and poor nutritional and environmental conditions. Management of cattle diets is labour intensive as feed is usually not abundant, and cut-and-carry systems predominate in many regions.

Reproductive traits of Bali cattle, as they are known from Indonesian, Australian, and Malaysian studies have been reviewed by McCool (1992) and Wirdahayati (1994). Key features gleaned from these reviews and other unpublished information include:

- Puberty is generally reached in males and females at 12-24 months of age and 100-150 kg.
- There is no evidence of a significant photoperiod effect on cyclicity.
- The average length of the oestrus cycle is 21 days.
- Oestrus is primarily a nocturnal event and lasts for an average of 18-19 hours.
- Pregnancy occurs after an average of 2 cycles.
- Pregnancy rates in cyclic females are high.
- Gestation is between 280 and 290 days.
- Calf birth weight averages about 17 kg, but may be less than 9 kg in poorly-nourished cows.
- Calf mortality is 2%-40%; higher levels occur in small calves and with poor management.
- Calving to conception intervals typically average near 5 months, indicating significant post-partum anoestrus.

Management of calving patterns and weaning achieves high reproductive efficiency in northern Australia with *Bos indicus* cattle and their crosses (Holroyd and Fordyce 2001). In 2001-2004 we evaluated a management system to match animal reproduction with supply of feed from pasture growth, crop residues and other feeds available to farmers for breeding cattle in the region as described by Poppi *et al.* (2010). This paper is the fourth in a series of fourth, and details animal reproduction in two eastern Indonesia villages.

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## MATERIALS AND METHODS

Details of sites, cattle management, and overall monitoring are described by Poppi *et al.* (2010). Within the project, cattle production was monitored at Kelebu and Tandek villages in the wet tropics of Lombok. Average annual rainfall is approximately 1500 mm. Monthly rainfall usually exceeds 250 mm from November to February, but only 5-10% of annual rainfall is received (usually 0-200 mm total) in the six months from May to October. Irrigation water is more consistently available at Tandek than Kelebu.

There were ~30 breeding-age female cattle kept in Tandek and ~40 in Kelebu. Traditional management was maintained in Tandek and included continuous mating either naturally or using artificial insemination, and weaning when calves were about one year of age. New management at Kelebu village required controlled seasonal natural mating using a selected bull and timed to meet animal performance (including draught power), business and social objectives. Maiden mating was at 2 years of age. Mating was for 7 months from early July in Kelebu. Maiden heifers and lactating cows detected in oestrus were introduced untethered to a bull pen generally twice during each oestrus that occurred during the designated mating season; conception date was derived from this data. These villagers also weaned calves at 5 months of age in the dry season, and at 6 months in the wet season.

A detailed monitoring system linked to unique individual animal identification was implemented, with data recorded by a village-based technical officer into books and computer files with the same format. For each calf birth year, dates of conception, calving dates, calf number, weaning dates, and mating outcome code were generated for each breeding-age female. The latter identified non-pregnancy, abortion, peri-natal loss, or calf weaned. Descriptive statistics were produced for fertility parameters within village.

## RESULTS AND DISCUSSION

Pregnancy rates at Kelebu were very high (Table 1) with very few calf losses (Table 2). The calving period was much more condensed than at Tandek (Table 2; Figure 1). If the 2001 mating represented the pre-study Kelebu situation and calf loss was 10% (conservative estimate from farmer interview), then pre-study weaning rates would have approximated 65%. The implementation of new management achieved (calculated) weaning rates of 85% and 94% in two consecutive years. Based on calves weaned and cows in the village, weaning rates in 2002 and 2003 were at least 75% and 90%, respectively. The high weaning rate in 2003 was coupled with a >25 kg increase in average progeny weight by the end of the year (Table 2), mostly because of concentrated calving.

**Table 1.** Pregnant Bali cattle at Kelebu with traditional (2001) and new management (2002-2003)

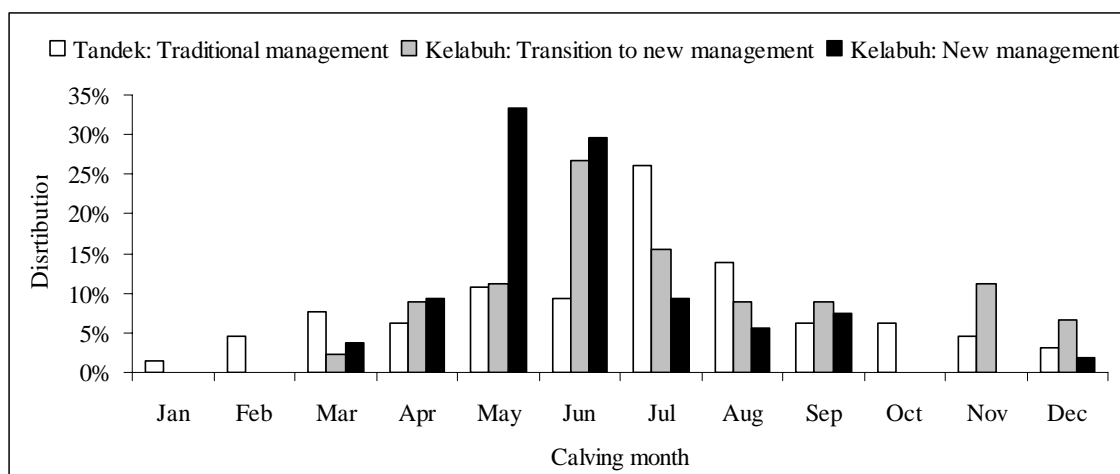
Mating year	Class	Mated	Jul-Sep	Jul-Dec
2001	Heifers	9	56%	78%
	Non-lactating	7	57%	57%
	First-lactation	13	38%	77%
	Mature lactating	21	52%	71%
2002	Heifers	14	71%	100%
	Non-lactating	10	80%	100%
	First-lactation	13	31%	69%
	Mature lactating	30	77%	87%
2003	Heifers	5	80%	100%
	Non-lactating	13	92%	100%
	First-lactation	15	67%	87%
	Mature lactating	36	83%	97%

At Tandek where village business was more trading than breeding, reproduction monitoring was very difficult due to a rapidly changing cow population. An average of 78% of lactating cows conceived within each year. Coupled with a 13% calf loss (Table 2), this equated to a 68% weaning rate from lactating cows. With the same calf loss, weaning rates from mating of non-lactating cows

and heifers would not exceed 87%. If 68% of cows were lactating each year, and 30% of breeding-age females were maiden heifers, overall weaning rate would not have exceeded 78%. With an average of 23 calves weaned annually, average weaning rate achieved was 76%. Calving distribution (Figure 1) showed a mid-year peak.

**Table 2.** Post-conception fertility parameters of Bali cattle

Village	Tandek	Kelebu		
	2001-03	2001	2002	2003
Management	Traditional	Traditional	Transition	New
Pregnant per mating	86%	71%	67%	86%
Calving to conception (days ± sd)	100 ± 42	69 ± 34	58 ± 28	70 ± 27
Gestation (days ± sd)	284 ± 20		284 ± 17	288 ± 10
Calf birth weight (kg ± sd)	16.3 ± 2.3	17.6 ± 1.5	16.3 ± 2.4	17.0 ± 1.6
Calf mortality	13%		4%	2%
Calved April-June	26%		50%	75%
Weaned by January	47%		50%	98%
Progeny weight: December (kg ± sd)	93 ± 31	76 ± 26	66 ± 28	102 ± 28



**Figure 1.** Monthly calving distribution

At Kelebu, one selected bull achieved 52-69 pregnancies each mating season, with a monthly peak of 28 in August 2003. The villagers experience was that a penned bull can successfully mate with at least 4-5 introduced oestrus females daily. At Tandek, limited mating data was available, but it did indicate that no bull was used for more than 6 matings in any month.

The opinion of weaning obtained from Kelebu farmer consensus discussion near the end of the study was:

- They agree that weaning is simple and easy.
- Cows are not unduly perturbed by weaning, ie, they only bellow when taken away from the calf pen.
- Males and females should be weaned separately as when mixed, they fight. The same applies for calves of different age or weight.
- Separation of calves from cows for about 3 weeks (variable and depends on regression of the udder) is needed to achieve weaning; ie, the cow will stop lactating and prevent the calf from attempting to suckle, and the calf will generally not attempt to suckle.
- Weaners only require average feed and no extra feed; no special diet is required.
- Less feed appears required for the cow-calf unit after weaning, rather than more, and post-weaning dry season growth increased by 5 kg.
- Cows lactating during the dry season suffer significant condition loss.

- The health, weight and body condition of neither the cow nor calf is adversely affected by weaning.
- Weaning enables share farmers to sell earlier to pay off owners.
- Most villagers are advising outsiders that weaning is a recommended practice.

Bali cattle show similarities to other *Bos* species, confirming previous reports: average birth weight is 6.3% of mature cow weight in comparison to 7.2% for Brahman (*Bos indicus*) cattle in north Queensland (Unpublished data); gestation length is intermediate to *Bos taurus* and *Bos indicus* cattle.

When strategic management was applied to Bali cows at Kelebu, the calving to conception interval was between 1 and 3 months for most cows. Post-partum anoestrus is the primary limitation to weaner production in re-breeding cows (Entwistle 1983). The short interval at Kelebu is a primary contributor to many cows weaning a calf annually. The interval was longer under traditional management at Tandek with the range being 1-6 months for most cows and an average of 100 days. This, coupled with higher calf losses, appear to be the main reason for weaning rates being limited to 76% at Tandek, ie, cows produce an average of 3 calves each 4 years.

Pregnancy rates of 67%-86% per oestrus compare well with up to 75% reported by Holroyd *et al.* (1993) in northern Queensland Brahman crossbreds and a more recent report of approximately 70% from a benchmarking study with disease-free *Bos indicus* cattle and their crosses in Queensland (Fordyce *et al.* 2005). This outcome was coupled with very low losses between confirmed pregnancy and weaning at Kelebu. The overall outcomes there were high pregnancy rates in all classes and an estimated 25% increase in village weaning rate to over 90%, indicating that Bali cattle have very high inherent reproductive capacity which is expressed when well-managed.

The early return to oestrus in well-managed Bali cattle and high pregnancy rates per oestrus when combined with controlled natural mating were major contributors to high average progeny weight by the end of each year at Kelebu. Our observation indicated that average progeny weight increased by >25 kg.

Calf mortality rate at Tandek, and from regional anecdotal reports including from Kelebu prior to the study appears to typically be over 10%. Though this is considered high locally, it is not significantly different from a benchmark study in Queensland where losses in Brahman crosses averaged 12% (Holroyd 1987). Based on pre-study agreements with Kelebu farmers, the period selected for seasonal mating avoided calving and early lactation under unsanitary wet season conditions, and minimised husbandry inputs during labour-intense cropping activities. The very low calf loss witnessed at Kelebu suggests these had been primary contributors to high previous losses.

The primary objective of weaning is cow body condition conservation, thus earlier re-breeding after calving. This practice was previously not implemented because of perceived adverse effects on animal performance and welfare, and because of local beliefs that suckling should occur for at least one year. Most Kelebu villagers now believe weaning is a good practice as was evidenced by preparation of weaning pens.

Studies in north Australia have shown that bull mating potential far exceeds the opportunity provided by most cattle owners (Fordyce *et al.* 2002). This has been further demonstrated in our observation where a selected bull was mated with up to 4-5 females daily with no significant energy expenditure and achieved almost all matings over the designated mating period. As well as increasing reproductive efficiency, the practice of using natural mating with selected bulls also provides villagers with genetic improvement opportunities.

Both weaning and the use of a natural mating with a selected bull were barriers to adoption in this project (Poppi *et al.* 2010). With direct support, these were overcome, and the recorded experience of the villagers was testament to their subsequent endorsement of these as routine practices.

## CONCLUSIONS

This study demonstrated that well-managed Bali cattle have high reproductive capacity when combined with seasonal controlled natural mating, thus concentrated calving, was major contributors to high average progeny weight. A selected bull was mated with up to 4-5 females daily with no significant energy expenditure.

#### LITERATURE CITED

- Entwistle, K.W. (1983). Factors influencing reproduction in beef cattle in Australia. *Australian Meat Research Corporation Review*. 43:1-30.
- Fordyce, G., Fitzpatrick, L.A., Cooper, N.J., Doogan, V.J., De Faveri, J., and Holroyd, R.G. (2002). Bull selection and use in northern Australia. 5. Social behaviour and management. *Animal Reproduction Science* 71, 81-99.
- Fordyce, G., Holroyd, R.G., and Burns, B.M. (2005). Minimising pregnancy failure and calf loss. Final Report, Project NBP.336, Meat and Livestock Australia, Sydney.
- Holroyd R.G. (1987). Foetal and calf wastage in *Bos indicus* cross beef genotypes. *Australian Veterinary Journal* 64:133-137.
- Holroyd, R.G., Entwistle, K.W. and Shepherd, R.K. (1993). Effects on reproduction of estrus cycle variations, rectal temperatures and liveweights in mated Brahman cross heifers. *Theriogenology* 40,453-464.
- Holroyd, R.G., and Fordyce, G. (2001). Cost effective strategies for improved fertility in extensive and semi-extensive management conditions in northern Australia. *In: 4<sup>th</sup> International Symposium on Animal Reproduction, Huerta Grande, Cordoba, Argentina. 22-24 June 2001.* pp 39-60.
- McCool, C. (1992) Buffalo and Bali cattle – exploiting their reproductive behaviour and physiology. *Tropical Animal Health and Production* 24:165-172.
- Poppi, D, Fordyce, G., Panjaitan, T., Dahlanuddin, Rutherford, A., Mashur, and Kurtz, E. (2004). Developing and integrated production system for Bali cattle in the eastern islands of Indonesia. Final report, Project ACIAR.AS2.2000.103, Australian Centre for International Agricultural Research, Canberra.
- Poppi, D., Dahlanuddin, Panjaitan, T. and Fordyce, G. (2010). Breeding *Bos javanicus* d'Alton cattle in eastern Indonesia. 1. Monitoring village cattle. *In: The 5<sup>th</sup> International Seminar on Tropical Animal Production, Yogyakarta, 19-22 October 2010.*
- Wirdahayati, R.B. (1994). Reproductive characteristics and productivity of Bali and Ongole cattle in Nusa Tenggara, Indonesia. PhD Thesis, University of Queensland, Australia.